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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

B Brief 9240

In re application of:

ROBERT M. RAYMOND et al.

Group Art Unit: 2652

Examiner: G. Letscher

Serial No.: 09/283,958

Filed: April 1, 1999

For: High Track Density Magnetic Recording Head

Attorney Docket No.: 98-075-TAP (STK98075PUS)

APPEAL BRIEF

Box AF
Commissioner for Patents
United States Patent and Trademark Office
Washington, D.C. 20231

Sir:

This is a brief on appeal from the final rejection of claims 50-82 of the Office Action dated March 29, 2001. This application was filed on April 1, 1999.

I. REAL PARTY IN INTEREST

The real party in interest is Storage Technology Corporation, a corporation organized and existing under the laws of the state of Delaware, and having a place of business at 2270 South 88th Street, MS 4309, Louisville, Colorado 80028-4309, as set forth in the assignment recorded in the U.S. Patent and Trademark Office on May 1, 1999 at Reel 9874/Frame 0536.

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8

I hereby certify that this paper, including all enclosures referred to herein, is being deposited with the United States Postal Service as first-class mail, postage pre-paid, in an envelope addressed to: Box AF, Commissioner for Patents, United States Patent and Trademark Office, Washington, D.C. 20231 on:

September 17, 2001	Mark D. Chuey, Ph.D.	
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II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences related to the present appeal.

III. STATUS OF CLAIMS

Claims 50-82 are pending in this application. Claims 50-82 have been rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

There are no pending amendments. A response after final rejection was filed on May 29, 2001. The Examiner upheld rejection of all claims in an Advisory Action mailed June 14, 2001.

V. SUMMARY OF THE INVENTION

With reference to Figures 1, 10a and 10b, Appellants provide for a magnetic recording head 20 for writing multiple data tracks 24 onto a magnetic media 26 traveling across the head 20 in a media direction 28. The head 20 includes thin film write elements 22, each having yoke 30 with a front region 32 defining a gap 36 and a back region 34 admitting loops of a conductive coil 38. A portion of each loop 38 is normal to the media direction 28. Each gap 36 is aligned along a position line 40. The yokes 30 are alternately positioned such that a first plurality of write elements 22 has each back region 34 on a first side of the position line 40 and a second plurality of write elements 22 has each back region 34 on a second side of the position line 40 opposite the first side.

VI. ISSUES

The following art has been referenced by the Examiner:

Reference	Title	Inventor(s)
EP 0 727 772 A2	Thin Film Coil Head Assembly with Protective Planarized Cocoon Structure	Gray (Gray)
USPN 5,978,188	Multitrack Tape Device using a Movable Magnetic Head with a Planar Surface and Including a Tape Support Device	Kaaden *et al.* (Kaaden)
USPN 5,274,521	Planar Thin Film Magnetic Head	Miyauchi *et al.* (Miyauchi)

Appellants identify the following issues with regards to the Examiner's characterization of Appellants' invention in view of this art:

1. Whether claims 50 and 62 are patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.
2. Whether claim 71 is patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.
3. Whether claim 73 is patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.

VII. GROUPING OF CLAIMS

A. Claims 50-70 are grouped together.

B. Claims 71-72 and 74-82 are grouped together

C. Claim 73 is grouped together.

VIII. ARGUMENT

The Examiner has rejected claims 50-82 under 35 U.S.C. § 103(a) as being unpatentable over Gray in view of Miyauchi and Kaaden. Appellants respectfully disagree with the Examiner's rejections.

1. Whether claims 50 and 62 are patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.

Claim 50 provides for a plurality of write element yokes. Each yoke has a front region defining a gap and a back region admitting loops of a conductive coil, as described on page 6, lines 2-21, as follows:

> Referring to Figure 1, a conceptualized drawing of the top view of a tape head according to an embodiment of the present invention is shown. Tape head 20 contains multiple write elements, one of which is indicated generally by 22, for simultaneously writing data tracks 24 on magnetic tape 26 as tape 26 travels across tape head 20 in tape direction 28. Each write element 22 includes yoke 30 having front region 32 and back region 34. Each yoke 30 includes an upper section connected with a lower section beneath the upper section shown in Figure 1. The upper section of yoke front region 32 defines gap 36. Yoke back region 34 admits conductive coil 38. The plane of each loop of conductive coil 38 is generally normal to tape 26. Loops of conductive coil 38 may encircle the upper section of yoke 30 as shown or, preferably, may encircle the lower portion of yoke 30 as described with regards to Figures 2 through 10 below. Other coil configurations may be used resulting in a different spacing efficiency between write elements 22. Current passing through conductive coil 38 induces magnetic flux in yoke 30. This magnetic flux creates a magnetic field across gap 36 writing information onto data track 24 as tape 26 passes over gap 36. Each gap 36 is substantially aligned along position line 40. Yokes 30 are alternately positioned to lie on either side of position line 40. By alternating the orientation direction of yokes 30, write elements 22 may be more closely spaced on tape head 20, permitting an increased number of data tracks 24 for a given width across magnetic tape 26.

Yokes are aligned relative to a position line such that a first plurality of write elements have a yoke back section lying on a first side of the position line and a second plurality of write elements have a yoke back section lying on a second side of the position line. This creates an alternating positioning of yokes, permitting the write elements to be more densely positioned on the recording head. Such alternating positioning is illustrated in Figures 1, 11 and 12.

The Examiner attempts to render such element positioning obvious by combining four sources of art: Figure 2 which Gray disparages as prior art (Gray2), an embodiment shown in Gray Figure 5 (Gray5), an embodiment shown in Gray Figure 7 (Gray7) and Figures 1-3 in Kaaden. Each of these will now be addressed.

a. Gray Figure 2

Gray2 shows two write elements, each with a flat planar coil. With regards to Figure 2, Gray states the following in column 2, lines 18-25:

> Unfortunately, thin film heads which employ planar spiral coil structures, such as coils 60 and 65 shown in FIG. 2, consume a relatively large amount of substrate area. This is especially true when multiple heads and multiple coil structures are situated on a common die 70 as illustrated. It is difficult to sufficiently miniaturize this planar spiral type of head assembly to fit within reduced size windows and slot in the head assembly.

The two elements shown in Gray2 appear to be mirror images constructed directly across from each other. There is no teaching or suggestion of a first plurality of write elements and a second plurality of write elements. Additionally, the two write elements are not alternately positioned to each other with respect to a position line. No position line is shown or described, nor is one proposed by the Examiner. Assuming such a position line runs between the elements in Gray2, the element are directly across from each other. No attempt has been made in Gray2 to save space by positioning the write elements in any type of alternating relationship. Thus, Gray2 neither teaches nor suggests Appellants' invention.

b. Gray Figure 5

Gray5 is a cross-sectional illustration of a single thin film element. (*See*, col. 5, ll. 31-32.) The Abstract summarizes the element structure as follows (emphasis added):

> A magnetic core (256) extends through an axial region of the coil structure. An elevated, thin film magnetic gap structure is positioned atop the coil structure. The gap structure includes a first top pole member (350) and a second top pole member (360)

> which are respectively magnetically coupled to the first and second ends of the magnetic core. A gap region (355) is formed between the first top pole member and the second top pole member.

Gray5 discloses a yoke comprising magnetic core 256, side pole layers 291, 292, side pole extensions 300, 305, first elevated yoke portions 320A, 320B, second elevated yoke portions 330A, 330B (See, Figure 4O), first top pole 350 and second top pole 360. Coil 212, 220 surrounds magnetic core 256. Gap 355 is formed between top poles 350 and 360 *directly over* coil 212, 220.

Neither Gray5 nor any text in Gray supporting Gray5 teach or suggest more than one magnetic access element. Gray actively teaches away from any positioning of multiple elements by constructing only single element rotary head assemblies. For example, column 17, lines 9-12, suggest mass producing single elements as follows (emphasis added):

> In actual practice, thousands of heads 110 are fabricated on a common die or substrate. At the completion of the fabrication process, the substrate is *diced up into individual heads* such as shown in FIG. 5.

(*See also*, col. 20, ll. 39-42.) Thus, Gray5 does not teach or suggest Appellants' arrangement of write elements as provided in claims 50 and 62. Further, as described above, Gray5 does not teach or suggest a single element as provided in claims 50 and 62.

c. Gray Figure 7

Gray7 is similar to Gray5. The relevant difference is that coils encircle the side of the yoke instead of the yoke bottom. In particular, Gray discloses a yoke comprising bottom magnetic layer 150', magnetic side poles 265', 270', first elevated yoke portions 320A, 320B, second elevated yoke portions 330A, 330B, first top pole 350 and second top pole 360. Coil loops 190', 235' encircle first magnetic side pole 265'. Gap 355 is formed between top poles 350, 360 *directly above* encircling coils 190', 235'. Thus, Gray7 does not disclose Appellants' yoke with a gap in a front region and coils in a back region.

The Examiner asserts that Gray7 discloses Appellants' yoke structure in the Advisory Action as follows:

> On page 3 of paper no. 9, Applicant states that there is not a front region defining a gap and a back region admitting loops of a conducting coil. The front region is the portion where the gap is located close to yoke 320 and the back region is towards the magnetic layer 150 where the coils are more closely located.

The Examiner is confusing top with front and bottom with back. The terms front, back, top and bottom are well defined in the specification. (*See, for example*, the paragraph quoted on page 4 above.) The use of these terms is in keeping with thin film construction art where the first layers deposited are said to be lower than later deposited layers. This confusion by the Examiner results in an untenable construction with regards to the clear language of claims 50 and 62. These claims provide for positioning elements such that a first set of elements have back regions on one side of a position line and a second set of elements have back region on the opposite side of the position line. Under the Examiner's construction, with back equaling bottom, one set of elements would be constructed upside-down, rendering them useless.

Neither Gray7 nor any text in Gray supporting Gray7 teach or suggest more than one magnetic access element. Thus, Gray7 cannot teach or suggest Appellants' arrangement of write elements as provided in claims 50 and 62. Further, as described above, Gray7 does not teach or suggest a single element as provided in claims 50 and 62.

d. Kaaden Figures 1-3

Kaaden discloses a moveable magnetic head having a plurality of elements or "active parts" positioned in a matrix arrangement as disclosed in the Summary of the Invention at column 2, lines 1-6, as follows:

> [The] device comprising at least a magnetic head having active parts for recording and/or reading microtracks, the active parts being arranged in a two-dimensional matrix within a substantially planar surface of the magnetic head ...

The Examiner asserts that Kaaden discloses Appellants' placement of write elements relative to a position line in the Advisory Action as follows:

> Kaaden et al '188 disclose a magnetic head assembly (5) having a first plurality of write elements 7 having their back regions on a first side of a position line, e.g., matrix (8), and a second plurality of write elements (7) on a second side of the position line opposite the first side. See Figures 1-2 of Kaaden et al '188 which shows the position (matrix) lines having write elements on either side of the line which splits the head write elements.

As shown in Kaaden Figure 1, each element 7 is positioned within a cell formed by matrix 8. A similar arrangement is illustrated in Figures 2 and 3. Each element is symmetric with what appears to be the gap located in the center of element. Thus, there is no front region defining a gap. In addition, there is no indication as to where coils are located or even if coils are used. There is simply no description of the element construction anywhere within Kaaden. Thus, Kaaden fails to teach or suggest Appellants' write element having a yoke with a front region defining a gap and a back region admitting loops of a conductive coil.

Kaaden also fails to teach or suggest positioning elements with regards to a position line. Kaaden teaches away from such an arrangement by positioning elements within cells of a matrix. Kaaden appears to suggest identical placement of elements in a grid structure, not alternately positioning yokes such that a first plurality of write elements have back regions on opposite side of a position line than back regions of a second plurality of write elements.

In summary, none of the references cited by the Examiner teach or suggest a write elements alternately positioned such that a first plurality of elements has each back region on a first side of a position line and a second plurality of elements has each back region on a second side of the position line opposite the first side.

2. Whether claim 71 is patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.

Claim 71 provides for a magnetic recording head having a plurality of write elements. Each write element includes a substrate parallel to magnetic media as the magnetic media travels by the head. A first magnetic layer is deposited on a portion of the substrate to form a lower section of a yoke. An insulating layer is deposited over a center portion of the yoke lower section. A second magnetic layer is deposited over the insulating layer and portions of the yoke lower section not covered by the insulating layer. The second magnetic layer forms an upper section of the yoke. The yoke upper section has a back region and a front region extending from the back region. The yoke upper section front region defines a gap. A conductive coil has a plurality of loops, each loop having a portion passing within the yoke such that at least a portion of each loop is *normal to the substrate*. The write elements are arranged such that the gap of each write element is aligned along a position line with the yokes alternately positioned such that a first plurality of write elements has each back region on a first side of the position line and a second plurality of write elements has each back region on a second side of the position line opposite the first side.

Gray5 is the only reference which discloses conductive loops encircling a lower yoke portion. As such, Gray5 has a portion of each loop which is normal to the substrate. However, Gray5 teaches away from other aspects of Appellant's invention. In particular, Gray5 illustrates a yoke having a gap directly above the coils, as described in the Abstract, a portion of which is reproduced as follows (emphasis added):

> A substantially helical thin film coil structure (220) is situated atop the substrate. A magnetic core (256) extends through an axial region of the coil structure. An elevated, thin film magnetic gap structure is *position* [sic] *atop the coil structure.*

As can be seen in Gray5, upper head structure 365 is formed directly over coils 212, 220. This produces a substantially symmetric head 110 with gap 355 in the center. Thus, there cannot be "a front region defining a gap and a back region admitting loops of a conductive coil" as provided by Applicants.

Further, Gray teaches away from any construction having a plurality of write elements in *any* configuration. For example, column 17, lines 9-12, suggest mass producing single element magnetic recording heads as follows (emphasis added):

> In actual practice, thousands of heads 110 are fabricated on a common die or substrate. At the completion of the fabrication process, the substrate is *diced up into individual heads* such as shown in FIG. 5.

In neither the final Office Action or the Advisory Action has the Examiner provided a motivation to combine Gray5 with any other teaching to create Appellants' invention of claim 71. This is because neither Gray nor any other reference provide such motivation.

In addition to these arguments, the arguments provided above with regards to Issue 1 apply to claim 71. In particular, no reference teaches or suggests write elements alternately positioned such that a first plurality of write elements has each back region on a first side of a position line and a second plurality of write elements has each back region on a second side of the position line opposite the first side.

3. Whether claim 73 is patentable under 35 U.S.C. § 103 over Gray in view of Kaaden.

Claim 73 provides that each loop of the conductive coil encircles the yoke upper section such that at least one portion of each loop passes above the yoke upper section. In neither the final Office Action nor the Advisory Action does the Examiner address claim 73.

Neither Gray nor Kaaden teach or suggest that each loop of the conductive coil encircle the yoke upper section. Further, attempting to encircle the upper yoke of Gray5 will fail. In Gray5, the gap is constructed directly above the coil encircling the lower yoke. An attempt to encircle the upper yoke with this coil will result in the coil extending above the gap, rendering the device inoperable.

The fee of $310 as applicable under the provisions of 37 C.F.R. § 1.17(c) is enclosed. Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 19-4545. A duplicate of this notice is enclosed for this purpose.

Respectfully submitted,

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Enclosure - Appendix

IX. APPENDIX - CLAIMS ON APPEAL

50. A magnetic recording head for writing multiple data tracks onto a magnetic media traveling across the head in a media direction, the head comprising a plurality of thin film write elements, each element having a front region defining a gap and a back region admitting loops of a conductive coil, a portion of each loop normal to the media direction, each gap aligned along a position line, the yokes alternately positioned such that a first plurality of write elements has each back region on a first side of the position line and a second plurality of write elements has each back region on a second side of the position line opposite the first side.

51. A magnetic recording head as in claim 50 wherein the write elements are formed on a common substrate.

52. A magnetic recording head as in claim 50 wherein each write element is operative to inductively sense field patterns written onto a data track.

53. A magnetic recording head as in claim 50 wherein each write element contains a read element within the yoke beneath the gap.

54. A magnetic recording head as in claim 53 wherein each yoke comprises an upper section and a lower section separated in a portion of the yoke under the gap by an insulating layer containing the read element.

55. A magnetic recording head as in claim 53 wherein the read element is a flux sensing read element.

56. A magnetic recording head as in claim 50 wherein the position line is normal to the media direction.

57. A magnetic recording head as in claim 50 wherein the position line forms an acute angle with the media direction.

58. A magnetic recording head as in claim 50 wherein each gap has a gap angle with the position line, each write element gap angle opposite in sign from the gap angle of the gap on an adjacent write element.

59. A magnetic recording head as in claim 50 wherein the magnetic media is magnetic tape.

60. A magnetic recording head as in claim 50 further comprising at least one additional plurality of write elements, each additional plurality of write elements having an associated position line, each write element in the at least one additional plurality of write elements having a gap substantially aligned along the associated position line.

61. A magnetic recording head as in claim 60 wherein each write element gap has a gap angle with the associated position line, each gap operative to write a data track on the magnetic media, each write element gap angle opposite in sign from the gap angle of a gap operative to write an adjacent data track.

62. A magnetic recording head for writing multiple tracks onto magnetic media traveling across the recording head, the recording head comprising a plurality of thin film write elements, each write element comprising a yoke having a back region and a front region extending from the back region when viewed in a

plane parallel to the magnetic media, the front region forming a gap and the back region admitting loops of a conductive coil, a portion of each loop normal to media traveling across the recording head, wherein a position line extends across the plane and intersects the projection of each track onto the plane and wherein the write elements are arranged with the yoke front regions aligned across the position line and the yoke back regions in a first plurality of write elements lying on a first side of the position line and a second plurality of write elements lying on a second side of the position line opposite of the first side.

63. A magnetic recording head as in claim 62 wherein each gap is a thin opening across the yoke front region in the plane, the thin opening defining an associated gap axis through the longest portion of the gap, each gap formed at a gap angle between the position line and the associated gap axis, wherein the gap angle magnitude is the same for each write element and the gap angle sign is opposite between adjacent write elements.

64. A magnetic recording head as in claim 62 wherein each write element is operative to inductively sense field patterns written onto a track on the magnetic media.

65. A magnetic recording head as in claim 62 wherein each write element further comprises a read element located within the yoke front region beneath the gap.

66. A magnetic recording head as in claim 62 wherein the yoke width tapers gradually from the back region to the front region narrower than the back region.

67. A magnetic recording head as in claim 62 further comprising at least one additional plurality of write elements, each additional plurality of write elements having an associated position line, each write element in the at least one additional plurality of write elements having a gap substantially aligned along the associated position line.

68. A magnetic recording head as in claim 67 wherein each gap is a thin opening across the yoke front region in the plane, the thin opening defining an associated gap axis through the longest portion of the gap, each gap formed at a gap angle between the position line and the associated gap axis, wherein the gap angle magnitude is the same for each write element and the gap angle sign is opposite between write elements operative to write adjacent data tracks.

69. A magnetic recording head as in claim 62 wherein the position line is normal to the direction the magnetic media travels across the recording head.

70. A magnetic recording head as in claim 62 wherein the position line is at an acute angle with the direction magnetic media travels across the recording head.

71. A magnetic recording head for writing multiple data tracks onto magnetic media traveling in a media direction over the head, the head including a plurality of write elements, each write element comprising:

a substrate parallel to the magnetic media as the magnetic media travels by the head;

a first magnetic layer deposited on a portion of the substrate, the first magnetic layer forming a lower section of a yoke;

an insulating layer deposited over a center portion of the yoke lower section;

a second magnetic layer deposited over the insulating layer and the portions of the yoke lower section not covered by the insulating layer, the second magnetic layer forming an upper section of the yoke, the yoke upper section having a back region and a front region extending from the back region, the yoke upper section front region defining a gap; and

a conductive coil comprising a plurality of loops, each loop having a portion passing within the yoke such that at least a portion of each loop is normal to the substrate;

wherein the gap of each write element is aligned along a position line, the yokes alternately positioned such that a first plurality of write elements has each back region on a first side of the position line and a second plurality of write elements has each back region on a second side of the position line opposite the first side.

72. A magnetic recording head as in claim 71 wherein each loop of the conductive coil encircles the yoke lower section such that at least one portion of each loop passes below the yoke lower section.

73. A magnetic recording head as in claim 71 wherein each loop of the conductive coil encircles the yoke upper section such that at least one portion of each loop passes above the yoke upper section.

74. A magnetic recording head as in claim 71, each write element having an orientation direction defined by a line from the yoke back region to the yoke front region, wherein each write element has at least one adjacent write element having the opposite orientation direction.

75. A magnetic recording head as in claim 74 wherein the front region of each write element yoke upper section is adjacent to the yoke upper section front region of the at least one neighboring write element.

76. A magnetic recording head as in claim 75, the gap comprising a thin slit across the yoke upper section front region at a gap angle relative to the written data track, wherein the gap angle of each write element is different than the gap angle of the at least one neighboring write element.

77. A magnetic recording head as in claim 71 wherein each write element is operative to inductively sense field patterns written onto a magnetic media data track.

78. A magnetic recording head as in claim 71 wherein the yoke upper section front region is located a greater distance from the substrate than the yoke upper section back region.

79. A magnetic recording head as in claim 78 further comprising a read element located in the insulating layer beneath the gap in the yoke upper section front region.

80. A magnetic recording head as in claim 79 wherein the read element is a magnetoresistive read element.

81. A magnetic recording head as in claim 71 wherein the yoke upper section back region gradually tapers to the width of the narrower yoke upper section front region.

82. A magnetic recording head as in claim 71 wherein the magnetic media is magnetic tape.